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Ascospores disseminate from these apothecia, causing primary infection in the rapeseed crop. See story on page 7.

Les ascospores sont éjectées des apothécies et provoquent une infection primaire dans les cultures de colza. Voir le texte descriptif en page 7.

CANADA AGRICULTURE

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MEAT TENDERNESS AFFECTED BY CARCASS CHILLING

R. L. CLIPLEF and
J. H. STRAIN

Des essais montrent qu'une réfrigération plus lente de la carcasse influence fortement la tendreté de la viande. Le boeuf sera plus tendre si, pour les premières 24 h, la température est maintenue à 7 ou 8°C au lieu de 1°C. Il semble que la prise de rigidité soit plus rapide, ce qui donne un raccourcissement moindre et une plus grande fragmentation des fibres musculaires, et une perte accrue de la sensibilité au calcium.

The meat industry and the consumer have been educated to prefer meat from cattle that have proceeded to market after a certain minimum period on a relatively high energy ration. This finishing or fattening process produced carcasses with a higher total fat content and yielded meat with a relatively high degree of marbling. Research has shown that this marbling is associated with tenderness, flavor and palatability. The increased costs of the higher energy feedstuffs in recent years have brought social and economic pressure on the industry to accept cattle off grass or cattle fed lower energy diets for possibly shorter periods of time. Carcasses from such cattle would be leaner and would grade lower and it is feared by some that the meat would be tougher and less palatable.

However, there are indications that the role of fat in making meat more palatable is not as great as previously supposed and that the postmortem handling of the carcass plays an important role in increasing the "eating quality" of the meat. It is on this premise that we undertook a test.

Since fat has the lowest thermal conductance of any tissue, it is quite likely that carcasses with more external fat cool at a slower rate, and that this slower cooling has an important effect on tenderness. If this is the case, leaner carcasses when cooled at a slower rate would produce beef of equal or superior quality to that of the fatter carcasses. It is also known that muscle fibers, when exposed to extreme cold prior to onset of rigor, contract to a fraction of their original length and become extremely tough. Slower cooling would reduce this cold shortening and contribute to the tenderness of the meat.

The test involved 27 carcasses from two ages of animals, 13.5 and 15 months of age. One half of each carcass went directly into the standard packinghouse coolers where temperatures were held at 1°C. The other half was held at 7-8°C for 24 hours and was then transferred to the standard packinghouse coolers. At this time, the halves were weighed, graded and scored for color, texture and marbling. Samples of longissimus dorsi muscle between the 11th and 13th ribs were removed

Dr. R. L. Cliplef and Dr. J. H. Strain are research scientists with the Agriculture Canada Research Station, Brandon, Man.

from each side 48 hours postslaughter and retained for testing and sensory evaluation.

Chemical analyses of the samples from right and left sides were almost identical and there were no differences for juiciness scores or for physical measurements of expressible juice. Lean color was significantly lighter for sides chilled at the higher temperatures. This was probably due to the more rapid decline in pH and to the fact that rigor mortis was more nearly complete. The results of shear tests, which measure the force required to shear through a 2.5-cm core of steak, are presented in Table 1. Cooked steak samples from sides chilled at the higher temperatures required less shear force, had higher tenderness scores, higher flavor scores and a higher overall rating than did the steaks from the side chilled at the lower temperature. Juiciness was the only palatability characteristic not significantly affected.

When cooked steak samples were presented to a trained taste panel, they preferred the steak from the slower chilled side 71% of the time (Table 2). The main reason for their choice was tenderness.

The results of our test thus seem to prove that our assumptions were correct. Slower cooling of carcasses does have a significant effect on meat tenderness. This practice likely gives rise to more rapid onset of rigor, which in turn results in less shortening and greater fragmentation of muscle fibers, increased loss of calcium sensitivity and more tender meat. ■

TABLE 1 ORGANOLEPTIC CHARACTERISTICS AND SHEAR VALUES OF COOKED LONGISSIMUS DORSI FROM TWO POSTMORTEM CHILL RATES

Variable	Fast Chill	Slow Chill
Shear kg[1]	7.3	5.9
Tenderness[2]	5.6	6.4
Juiciness[3]	6.0	6.0
Flavor[4]	5.6	6.2
Overall rating	5.8	6.2

[1]Kg force required to shear a 2.5-cm diam core.
[2]Rated on a 10-point scale, 10 being most desirable.
[3]See footnote 2.
[4]See footnote 2.

TABLE 2 TASTE PANEL PREFERENCE

	Preference as % of choices	Reason for preference as %		
		Tenderness	Juiciness	Flavor
Left side (fast chill)	28	45	36	19
Right side (slow chill)	71	76	10	14
None	1			

A HERBARIUM IN ACTION

JANET L. STEVENS

L'Herbier national de mycologie d'Ottawa est la plus importante collection de champignons du pays et élabore, pour fins de recherche et de consultation, des données précises sur leur identification et leur classification.

A herbarium is a collection of preserved, usually dried plant specimens. The National Mycological Herbarium is a collection of dried, predominantly Canadian fungi. They are housed in Agriculture Canada's William Saunders Building at the Central Experimental Farm in Ottawa. This collection of fungi is the largest in Canada and among the largest in the world. All groups of fungi are represented — mushrooms and toadstools, rusts, smuts and moulds, fungi causing wood rots, leaf and stem spots, and slime, aquatic, and soil and air-borne fungi.

The dried fungus collections are filed in folders or boxes, which are kept in steel cabinets. Each fungus added to the collection has to be identified, packaged and assigned an accession number. The name of the collector, the host or substrate on which the fungus was found, location, and date of collection must be printed on the package label, and the collection indexed as to host.

The Herbarium constitutes a research tool which is used daily by the mycological staff of the Biosystematics Research Institute, and which is available to scientists at research stations, universities and institutes throughout the world. What are the practical advantages, however, of maintaining such a large collection of fungi?

Janet Stevens is a herbarium technician at the Biosystematics Research Institute, Agriculture Canada, Ottawa, Ont.

The National Mycological Herbarium maintains a collection of over 200 000 dried fungus specimens

Herbaria, like museums, have a number of functions. Their collections serve, for example, as reference tools, historical records, teaching aids, or as a body of data for taxonomic research. The National Mycological Herbarium contributes to all these functions, but its main one is to support taxonomic research. This calls for investigations into the structure, life cycle and distribution of fungi. This information leads to classification, which is a basis for identification.

Identification and naming are essential for any communication, but in scientific work it is particularly important for accurate identifications to be made so that any previous work on fungus effects, hosts and control measures can be brought together in the knowledge that all are talking about the same thing. For almost a century in North America, workers confused *Tilletia brevifaciens*, the fungus causing dwarf-bunt disease of winter wheat, with *Tilletia caries*, the agent of the common-bunt disease. The two diseases were treated as one until the fungi causing them were distinguished.

Conversely, one fungus may cause distinctly different symptoms on the host or hosts under different conditions. Common root rot of cereals, under study at the present time, is an example of this. In western Canada, this fungus attacks the

Top left — the mushroom (*Leucopaxillus albissimus*), common on needle beds. Top right — a wood rotting fungus (*Polyporus sulphureus*), on butternut. Bottom left — black knot fungus (*Apiosporina morbosa*), on chokecherry. Bottom right — rust fungus (*Endophyllum lacus-regis*), on spring beauty.

root system of wheat, reducing yield markedly. In eastern Canada, it appears as a leaf spot of barley. The symptoms are not alike, but are caused by the same fungus, called *Cochliobolus sativus*.

Identification of specimens can be made by recognition, comparison with a known species, or by using a taxonomic key, which is a scheme of identification-by-elimination, made possible by taxonomic classification. Classifications can be drawn up only from the detailed study of many specimens of related species. The data for this study are provided in the herbarium. It is the only place where field collections of members of a widely distributed group can be compared in the same place in the same state at the same time.

A good classification scheme is a tool which can be used not only for identification, but also prediction. Dutch Elm disease is caused by *Ceratocystis ulmi* and Oak Wilt by *Ceratocystis fagacearum*. *Ceratocystis coerulescens* causes sapstreak of sugar maple and yellow poplar, resulting in the death of large trees. Blue stain in pines attacked by certain beetles is caused by other *Ceratocystis* species. Thus, any fungus that is identified as *Ceratocystis* is suspected as a potential hazard and before entry into the country is permitted, it must be tested very carefully to ensure that it is not a pathogen capable of causing economic damage.

To support basic taxonomic research, the National Mycological Herbarium maintains a collection of over 200 000 dried specimens, some of which date back to the 19th century and many to the early 1900s when the Herbarium was founded. Most of these specimens have been collected in Canada. Some are from the United States, and a smaller percentage from Europe and from countries all over the world. Many specimens have been obtained by staff mycologists on field trips, by exchanges with herbaria from other countries, and occasionally by purchase. The herbarium also receives fungi sent for identification by workers in agriculture, forestry, industry and universities and by the general public. World-famous collections such as the John Dearness Herbarium, Dr. W. L. Gordon's *Fusarium* collection from the Dominion Rust Research Laboratory at Winnipeg, and over 70 Exsiccatae sets of dried specimens from Europe and North America are also housed here.

The collections in the herbarium are historically and scientifically unique; in fact, they are irreplaceable. They provide the basic data for taxonomic research, serve as comparison specimens for identification, supply information about the known hosts of a fungus, and provide ecological and geographical records. The Mycological Herbarium is an invaluable national resource serving many purposes. ■

SCLEROTINIA IN RAPESEED

J. DUECK

La pourriture sclérotique, maladie très répandue depuis deux ans dans les principaux centres de culture du colza en Saskatchewan et en Alberta, peut entraîner de fortes baisses de rendement. La meilleure façon de la combattre pour le moment semble être l'application de fongicides. La lutte biologique et l'hybridation sont, à long terme, dans le domaine du possible.

Sclerotinia stalk rot has been a prominent disease in the major rapeseed growing areas of Saskatchewan and Alberta during the past 2 years. The unusual severity of the disease has created a high level of interest. This disease can cause considerable loss in rapeseed yields and its occurrence is seemingly unpredictable. In addition, the fungal sclerotia in the harvested crop are considered an objectionable contaminant by one of our export customers.

Sclerotinia sclerotiorum has two mechanisms for survival. It may remain in its active vegetative form, mycelium, in debris of infected plants. In addition to being a pathogen of many species of broad-leaf plants, it is an active saprophyte and grows well on a wide variety of organic substrates. Secondly, it produces sclerotia which are capable of maintaining the fungus in a dormant

Dr. Dueck is a plant pathologist for oilseed crops with the Agriculture Canada Research Station, Saskatoon, Sask.

state. Sclerotia are basically storage organs, like seeds of higher plants, but are more versatile. Given moisture, sclerotia may germinate directly to form the vegetative mycelium. They may also germinate to form sexually reproductive structures known as apothecia. Each apothecium contains a multitude of ascospores which are released into the air to be dispersed by even the slightest air currents.

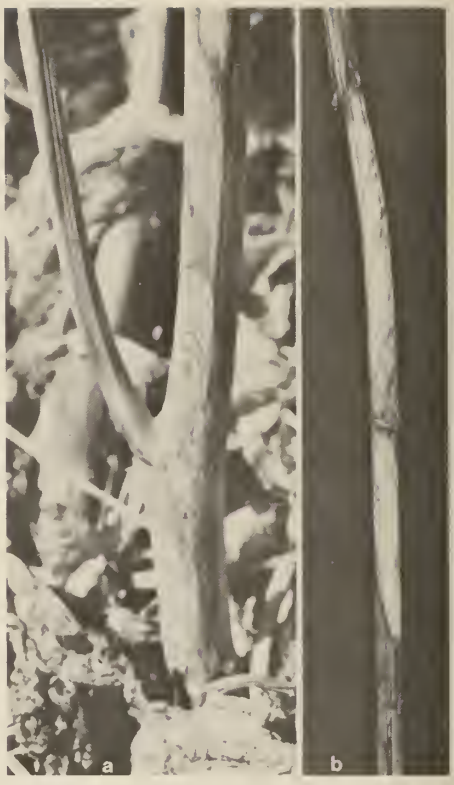
In soil, sclerotia have a number of natural microbial parasites and antagonists. The most notable of these is *Coniothyrium minitans*, a fungus which completely digests sclerotia. The majority of sclerotia do not survive in the soil for more than 2 or 3 years because of parasitism and other unknown factors. However, new sclerotia are produced to perpetuate the population as long as the organism has a suitable host plant or organic substrate.

Plant infection occurs by means of mycelium growing from sclerotia or infested plant debris, or via airborne spores. Infection by mycelium usually begins at the base of the plant and progresses upward, whereas infection by spores may occur on any aboveground portion of the plant. When infection is primarily by mycelium, the disease is characteristically found in distinct patches in the field. If the predominant mode of infection is by ascospores, infected plants tend to be more uniformly distributed throughout the field. In the severe epidemics of the last 2 years, the latter type of infection has been most prevalent. Irrespective of the mode of infection, the end result is the same, namely wilting and death of the plant due to destruction of the vascular system.

Infected plants are conspicuous in a field of rapeseed because they become straw colored long before adjacent healthy plants do. In addition, stems of infected plants have a distinct greyish white, often zonated lesion. New sclerotia are formed on the inside of the diseased sections of stems and occasionally also on the surface of roots. Sclerotia formed inside stems on the upper portions of plants are frequently harvested along with the rapeseed. Even slight agitation releases sclerotia from these stems shredded by fungal enzymes and combine screens are unable to separate them from the crop. The mode of infection thus influences the distribution of infected plants in the field as well as dispersal of the organism in the harvested crop.

The amount of damage done to the crop depends on the number of plants infected and the stage of growth at time of infection. Plants infected in the early flowering stage produce little or no seed, but those infected when fully podded suffer little reduction in yield. Yield loss results from smaller and fewer seeds in infected plants. The shattering of plants which have ripened prematurely due to infection is an additional yield loss factor. In five fields sampled to determine yield loss in the Melfort area of northeastern Saskatchewan in 1976, 24% to 42% of the plants were infected.

Sclerotia in rape seed. They are storage organs, capable of causing infection.



Sclerotinia infected rapeseed plants. (a) The lesion at the plant's base is caused by mycelial infection. (b) The lesion on the upper part of the stem is a result of infection by airborne ascospores. Note healthy tissue above and below the infected area

Loss in yield ranged from 15% to 28%. It was assumed that all seed could be harvested, however, and losses due to shattering were not accounted for. Actual farm losses may therefore be substantially greater. Because of the magnitude of yield losses inflicted by this disease, it is imperative that control measures be developed.

Unlike most plant pathogens, *S. sclerotiorum* is relatively non-specific in the species of plants it infects. More than 300 species, all dicotyledonae, are susceptible. Although there appear to be differences in susceptibility among rapeseed lines, we have found that breeding for resistance to an organism with such a vast pathogenic potential is a formidable task. Our research has also revealed that crop rotation is of limited value as a control measure because of the wide host range and the ability of the fungus to perpetuate itself in the absence of a susceptible host. For the immediate future, it appears that fungicides offer the most promise for control and a number of existing ones are known to have potential. Dosage rates and optimal application timing need to be developed as well as methods for prediction of disease incidence. In the longer term, biological control and breeding for resistance may become feasible.

Incidence of *Sclerotinia* stalk rot is favored by conditions optimal for growth of the rapeseed plant. In 1976, when average rapeseed yields were the highest ever recorded, stalk rot was more severe than in any previous year. Because of the high incidence of disease, however, individual growers did not achieve the maximum potential yield from the rapeseed stand in their fields. ■

MAKING IT TOUGH FOR THE CORN BORER

M. HUDON and
M. S. CHIANG

Les spécialistes ont élaboré un programme d'amélioration du maïs-grain en vue de sa résistance à la Pyrale du maïs. A cette fin, plusieurs lignées de maïs provenant du monde entier sont évaluées pour leur précocité et leur résistance à la Pyrale. Chaque année, plusieurs milliers de plantes de maïs en plein champ sont infestées artificiellement de masses d'oeufs de Pyrale produites en laboratoire à l'aide d'une diète synthétique à base de germe de blé.

Marcel Hudon is a research entomologist and Morgan Chiang is a plant geneticist, at the Agriculture Canada Research Station, St-Jean, P.Q.

The European corn borer, a polyphagous species, is the most serious insect pest of corn in eastern Canada. It is well adapted to North American conditions and has few natural enemies. Its development and spread, throughout all parts of the American corn belt, have been greatly aided by the protective topography of the land coupled in many instances with inadequate use of good cultural practices. Borer attacks cause damage to sweet corn, the preferred host, and to grain and silage corn. The latter type is the least damaged, since it is harvested at the green stage of corn development before the insect becomes well established in the stalks. The economic value of sweet corn justifies insecticidal treatment, but this is not the case with grain and silage corn. There is a great demand for grain corn which would be resistant to the borer.

Life history of the corn borer The corn borer overwinters in the stalks of the plants as a larva, and is in a dormant state. In June, it pupates and a few weeks later, the moths will start to lay their eggs on the foliage of the corn plants. The young larvae start eating the plant at the whorl stage, in July, and continue boring until harvest. Corn borer populations vary from year to year and from field to field. In the areas where the insect reproduces several times in a season, the time taken to reproduce cuts down the larval feeding and reduces the damage.

The primary injury from first-generation infestation is a direct reduction in yield which is largely fixed before the stalk and ear attack becomes serious. However, quality may also be later reduced through grain damage. The introduction of stalk and ear rots at points of borer injury contributes largely to stalk breakage, ear droppage and yield reduction.

Development of resistant varieties

Insecticidal treatment of grain corn crops is generally uneconomical, and an attempt is being made to breed synthetic varieties, inbred lines and eventually hybrids resistant to the corn borer.

A program to develop early corn inbred lines resistant to this insect has been operating at the St-Jean Research Station since 1969, when Canada joined the International Cooperative Project on the corn borer (Canada Agriculture, Fall 1970). The Project now involves 15 countries throughout the world. The St-Jean Research Station is also presently cooperating with four universities, three federal research stations, the Plant Gene Resources of Agriculture Canada, eight commercial companies in the United States, Canada and France, and eight European corn research institutes, apart from its involvement in the International Cooperative Project. Hundreds of inbred lines and hybrids have been screened to search for resistant germplasm.

Our objective at St-Jean is to breed corn for resistance to the corn borer when plants are at the whorl stage and have some tolerance to the borer until harvest time. To avoid wide fluctuations in natural corn borer populations from year to year, it is important to hand-infest plants with egg masses produced in the laboratory.

The technique for mass production of corn borer eggs was obtained from the U.S.D.A. laboratory at Ankeny, Iowa. Larvae in the dormant stage are collected from corn plants at harvest, put in corrugated paper in small metallic-covered boxes, and placed in a refrigerator at 4°C for a minimum of 2-3 months. They are removed in February, put in glass vials and allowed to pupate in a rearing room with the temperature at 27°C and humidity at 80%.

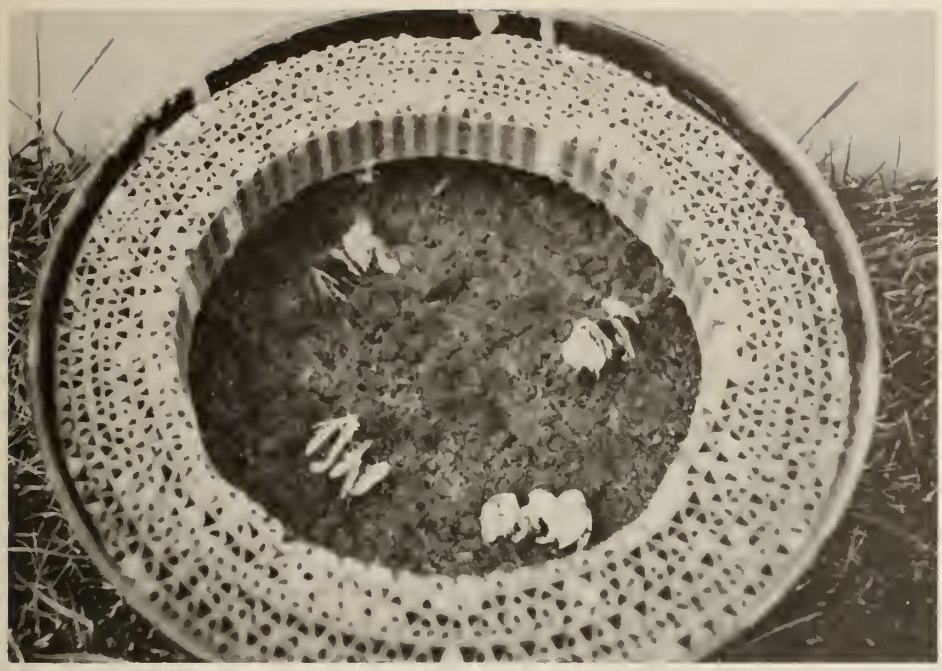
Newly-emerged moths are transferred to screened cages where the females deposit their eggs on strips of waxy paper. In about 5 days, when the eggs are ready to hatch, they are put in plastic dishes which contain an artificial diet and the young larvae feed on this diet for about 28 days before pupating under complete light. The setting up of these dishes begins in May and continues for 4-5 weeks for the mass production. Once the adults are obtained from the corrugated paper rings in the moth emergence room under complete darkness, 100 males and 100 females are placed in screened cages. The cages are sprayed with water twice daily to prolong the life span of the moths. Normally, moths live for about 12 days. The oviposition room is operated in complete darkness at a temperature of 27°C for 18 hrs and 18°C for 6 hrs each day with a series of time clocks operating a heater and air conditioner; the humidity is about 85%. The cyclic temperatures are required to insure adequate mating.

To speed up the mass production, an electric cutting machine was built to cut the paper on which the egg masses are deposited into small round discs, each containing one or two masses. The maximum

The female moths deposit their eggs on waxy paper on top of the cage. The papers are removed daily.

number of discs made in 1 day in 1976 was 16 000. About 75 000 egg masses are required in the breeding program at St-Jean. Once cut, the discs are pinned on an insect needle. About 25 are put on each one. These needles are placed in Petrie dishes — about 10 per dish. All egg masses are incubated at near the hatching point (blackhead stage) before being placed in corn plants. The egg production has to be well synchronized with the growth of the plants. The Petrie dishes are brought regularly to the experimental field in early July and the discs are deposited in the whorl of the plants. For inbred lines, each plant receives four egg masses and for hybrids, six. In 1976, 240 inbreds and 50 hybrids were screened.

Three to four weeks after the deposition of the egg masses, the plants are evaluated for leaf-feeding damage and given a score from 1 to 9, depending on the size and number of lesions or holes in the leaves. In addition to foliar inspection, stalks and ears are rated to evaluate the tolerance of the plants at har-



The larvae transform to the pupal stage on the corrugated paper on top of the plastic dish.

Discs being deposited in the whorl of a corn plant. On the right, the technician's hand is holding an insect needle containing 25 discs.

vest. With the single brood borer, the amount of tunnelling and stalk breakage is appreciable; in 1976, 15-35 cm of tunnels per plant were considered intermediate for inbred lines and 20-45 cm for hybrids. To obtain a satisfactory yield in Quebec's production season, plants must have reached the silking stage within 85 days or less from the time of planting.

This intensified program of screening and selecting corn inbred lines will lead to promising sources of genetic resistance to the corn borer. It permits the study of the inheritance of resistance to this insect, yield losses caused and the creation of synthetic varieties and early resistant inbred lines for release. ■

FEED ANALYSIS — TAKES GUESSWORK OUT OF FEEDING

RALPH E. McQUEEN

Farmers need accurate information on the nutritional value of homegrown feeds to achieve efficient production and growth of livestock. Both over-feeding, and under-feeding can be wasteful in these days of rising feed costs.

Unfortunately, the nutritional qualities of individual feeds are rather unpredictable. Many factors contribute to the variation: soil conditions, level and type of fertilizer, variety of forage or cereal crop, purity of stand. stage of maturity when cut, extent of weathering, and losses incurred in harvesting and storing.

Consequently, an accurate appraisal of a particular feed from feed tables is not possible. The crude protein of a legume forage, for example, may range from 5 to 30%. The only way to get reliable information on these nutrients is by laboratory analyses.

By using a combination of a few analyses, very useful information for feed formulation is obtained.

A variety of analyses and services is offered by the provincial feed analysis laboratories across Canada. Methods and inferences drawn from the test results are not uniform. This lack of agreement is most apparent in the categories used to describe the available energy in feeds.

A major source of inaccuracy in feed analysis is the sampling procedure used on farms. Only a small quantity of feed is analyzed, so care must be taken to ensure that it represents the entire lot of grain or forage. Extension workers play a valuable role by helping farmers use good sampling procedures.

Dr. McQueen is a research scientist at the Agriculture Canada Research Station, Fredericton, N B.

Costs to farmers vary from nothing in the Atlantic Provinces to fees for a "package" of analyses in other provinces.

All provinces provide extension workers to assist farmers in interpreting the analyses and in formulating rations. Least-cost formulas using results of analyses and current costs are easily calculated using computers. However, results from computers are only as good as the data fed to them. The value of the resulting rations depends on the accuracy of the estimates of their nutritive quality.

L'ANALYSE DES PROVENDES, POUR UNE ALIMENTATION PRÉCISE

RALPH E. McQUEEN

Pour obtenir de leur bétail une production efficace et un bon régime de croissance, les agriculteurs ont besoin de données exactes sur la valeur nutritive des aliments qu'ils produisent à la ferme. Dans cette époque d'inflation, il peut être tout aussi ruineux de suralimenter que de sous-alimenter les animaux.

Malheureusement, la valeur nutritive des aliments, d'où qu'ils viennent, est assez difficile à prévoir, et cela pour divers causes, notamment: l'état du sol, la dose et le type d'engrais utilisé, le type de culture fourragère ou céréalière, la pureté du peuplement, le stade de maturité à la récolte, l'importance des altérations et les pertes à la récolte et à l'entreposage.

Les tableaux de composition des éléments ne donnent pas toujours une appréciation exacte d'un aliment particulier. Le taux de protéines brutes des légumineuses fourragères par exemple, varie de 5 à 30%. Seule l'analyse en laboratoire fournit des données exactes sur ces nutriments.

En combinant diverses analyses, on obtient de précieux renseignements pour la préparation des aliments.

Les laboratoires provinciaux d'analyse des aliments offrent toute une gamme de services et d'analyses mais leurs méthodes varient de même que les déductions qu'on peut tirer des résultats. Ainsi, on se sert de diverses catégories pour décrire l'énergie disponible. Toutefois, la principale source d'inexactitude demeure la méthode d'échantillonnage utilisée à la ferme. Seule une très petite quantité est analysée. Il faut donc s'assurer qu'elle est bien représentative de la totalité. Les agronomes locaux peuvent grandement aider les agriculteurs à prendre des échantillons réprésentatifs.

Dans les provinces de l'Atlantique, ces services d'analyse sont offerts gratis aux agriculteurs alors que dans d'autres, un paiement nominal donne droit à tout un bloc d'analyses.

Toutes les provinces offrent aux agriculteurs des services de vulgarisation afin de les aider à interpréter les analyses et à établir la composition de leurs aliments. L'ordinateur calcule sans peine les formules les plus économiques à partir des résultats d'analyse et des coûts courants, encore que la valeur des résultats obtenus de l'ordinateur dépende de celle des données qui lui sont fournies. En effet, la valeur de la ration dépend de l'exactitude de l'évaluation de sa qualité nutritive.

A farmer's feed sample is weighed in the laboratory at the Alora Research Station to determine dry matter content and will then be analyzed chemically for the amount of protein. The photo was supplied by OMAF

Un échantillon d'aliment du bétail envoyé par un fermier est pesé au laboratoire de la Station de recherche de Alora, afin de déterminer le montant de matières sèches. Il sera plus tard analysé pour connaître sa valeur protéique. Photo de l'OMAF

M. McQueen est chercheur scientifique à la Station de recherche d'Agriculture Canada à Fredericton, N.-B.

TABLE 1 SUMMARY OF PROVINCIAL FEED ANALYSIS SERVICES IN CANADA

Province[2]	Analyses[1]						Interpretation — Estimate of			
	Dry matter	Crude protein	Heat-damaged protein	Fibre estimates	Ca & P	Other minerals[3]	Dry matter digest-ibility	TDN	Digestible energy	Net energy
Prince Edward Island	Yes	Yes	No	No	Yes	Yes	No	Yes	No	Yes
Nova Scotia	Yes	Yes	No	No	Yes	Yes	No	Yes	No	Yes
New Brunswick	Yes	Yes	No	No	Yes	Yes	No	Yes	No	Yes
Quebec	Yes	Yes	No	No	Yes	Yes	Yes	No	No	No
Ontario	Yes	Yes	Yes	No	Yes	Yes	No	No	No	No
Manitoba	Yes	Yes	No	Yes	Yes	Yes	No	Yes	No	No
Saskatchewan	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No
Alberta	Yes	Yes	No	Yes	Yes	Yes	No	No	Yes	No
British Columbia	Yes	Yes	No	Yes	Yes	Yes	No	No	Yes	No

[1] Information was collected in 1975-76.
[2] Newfoundland has no service, but uses that of Nova Scotia for certain problem feeds
[3] Includes potassium, magnesium, copper, manganese, zinc, nitrate. ■

TABLEAU 1 SOMMAIRE DES SERVICES PROVINCIAUX D'ANALYSE DES PROVENDES

Provinces[2]	Analyses[1]						Interprétation — Évaluation			
	Matière sèche	Protéines brutes	Protéines thermo-labiles	Teneur en cellulose	Ca & P	Autres minéraux[3]	Diges-tibilité matière sèche	UNT	Énergie diges-tible	Énergie nette
Île-du-Prince-Édouard	Oui	Oui	Non	Non	Oui	Oui	Non	Oui	Non	Oui
Nouvelle-Écosse	Oui	Oui	Non	Non	Oui	Oui	Non	Oui	Non	Oui
Nouveau-Brunswick	Oui	Oui	Non	Non	Oui	Oui	Non	Oui	Non	Oui
Québec	Oui	Oui	Non	Non	Oui	Oui	Oui	Non	Non	Non
Ontario	Oui	Oui	Oui	Non	Oui	Oui	Non	Non	Non	Non
Manitoba	Oui	Oui	Non	Oui	Oui	Oui	Non	Oui	Non	Non
Saskatchewan	Oui	Oui	Oui	Non	Oui	Oui	Oui	Oui	Non	Non
Alberta	Oui	Oui	Non	Oui	Oui	Oui	Non	Non	Oui	Non
Colombie-Britannique	Oui	Oui	Non	Oui	Oui	Oui	Non	Non	Oui	Non

[1] Les données ont été recueillies en 1975 et 1976.
[2] Terre-Neuve a, à l'occasion, recours aux services d'analyse de la Nouvelle-Écosse.
[3] Comprend le potassium, le magnésium, le cuivre, le manganèse, le zinc et les nitrates. ■

SPARTAN OPENS DOOR TO NEW MARKETS

D. W. MacDONALD

Spartan, créée dans le cadre du programme d'amélioration des pommes du ministère de l'Agriculture du Canada, rapporte des dividendes en suscitant de nouveaux débouchés sur les marchés intérieurs et extérieurs, et en augmentant le revenu des producteurs à cause de son classement supérieur à McIntosh.

The solid, deep red blush is characteristic of Spartan.

For years, McIntosh has been the big name in apples. It's the most widely planted variety in the moderate to cool apple growing regions of Canada and the United States. It has a well-earned reputation, among growers for its productivity, and among consumers for its eating quality. But growers continue to look for a better apple, preferably one that would extend the marketing season through better storage capabilities. B.C. growers believe they have another winner in Spartan. No variety has had more impact on the market in recent years than this highly colored, red, crisp, dessert apple.

The accompanying table illustrates the growth in production of Spartan, and long storage life. K. M. Hunter, Chief of Agriculture Canada's Merchandising and Licensing Section of the Fruit and Vegetable Division points out that storage holdings on December 1 increased from 714,000 lb in 1963-64 to 53.5 million lb in 1976-77.

"Spartan is steadily gaining market acceptance for its excellent coloring and flavor," Hunter observes. "The smaller sized fruit with good color are ideal for children. Spartans have the type of skin and pulp texture to withstand the increased bruising that occurs when apples are marketed in polyethylene bags. No other area produces the degree or intensity of color found in the Okanagan."

Spartan became a significant factor in apple sales with B.C. Tree Fruits, the growers marketing agency, in 1965 when growers harvested 285,000 40-lb boxes. The McIntosh crop that year was 1.5 million boxes. The volume of Spartan shipped to the fresh market from 1965 varied from 300,000 to 500,000 boxes a year until 1974 when 830,000 boxes were marketed. Last year a record crop was estimated at 994,000 boxes.

In five years Spartan has become a significant and important part of B.C.'s marketing program. It presents certain challenges too, since this marketing agency still handles a crop of two million boxes of McIntosh a year. Ideally, rather than compete for the McIntosh trade, Spartan should open the door to new markets.

And that's what it's doing. The fact that Spartan can be picked later than McIntosh, holds particularly well in controlled atmosphere (C.A.) storage till March and April, and has superior handling characteristics gives it an advantage.

Western Canada has been the traditional market for B.C. McIntosh, so the growers marketing agency is

PRODUCTION AND STORAGE HOLDINGS — SPARTAN APPLES ('000 lb)

	Production	Storage Holdings	
		Dec. 1	May 1
1963-64		714	672
64-65		2,058	588
65-66		12,768	504
66-67		15,414	462
67-68		23,100	542
68-69	12,936	12,012	420
69-70	27,300	22,300	3,578
70-71	28,686	25,208	586
71-72	25,334	15,907	442
72-73	34,188	27,361	738
73-74	45,579	33,550	2,396
74-75	34,765	24,789	1,816
75-76	51,178	42,234	12,428
76-77	60,625	53,521	

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Fruit and Vegetable Division, Ottawa, February 8, 1977.

looking elsewhere to sell Spartan. Market development work has been successful in Montreal, and to a lesser extent in Toronto, where there has been a good demand for Spartan in 3-lb bags.

What are the prospects for export sales? To date, California has been the best export market according to B.C. Tree Fruits. The variety has found favor there almost from the time Spartans reached commercial production in the Okanagan Valley. A chain of stores in Philadelphia has also taken Spartan consistently for the past three seasons.

Generally, in the United States, it has been difficult to sell Spartan, in volume, while McIntosh are available. Once the Extra Fancy McIntosh are out of the way however, the chains turn to Spartan.

Further acceptance of the new variety by chains in the eastern United States, marketing specialists believe, will depend on the availability and pricing of eastern grown McIntosh in any given season.

Surveys by B.C. Tree Fruits show that the Okanagan Valley is the only area producing Spartans in commercial quantities in .North America. Some Spartans have been planted in Ontario, Michigan and New England, but not in large numbers.

Spartans produced commercially in Denmark, have found an export market in Sweden and Finland. B.C. has shipped Spartan to Norway for the past two years and a few hundred boxes have been supplied to Hawaii. Another new market was opened in Colombia for the 1976 crop.

B.C. marketing specialists predict that Spartan will return more money than McIntosh this year because of its better grade-out and sounder condition. Prospects are good, they believe, provided a marketing development program is continued in Eastern Canada, U.S.A., and offshore markets. Given good crops of quality fruit, Spartan could have, within a few years, a greater overall market demand than McIntosh.

Developing new varieties of apples that will help Canadian growers compete with the more exotic types on the domestic and export markets has been an objective of the Canada Department of Agriculture since the original experimental farms were located across the country. Spartan is just one of a number of varieties resulting from breeding programs at these stations. Other varieties that have paid off because of this work include Melba and Lobo. Bancroft is grown to a limited extent in Quebec for its hardiness, late maturity and good keeping qualities. Summerred, released to growers in 1964 from Summerland, B.C., also shows promise.

Spartan resulted from a cross between McIntosh x Newtown, made in 1926 at the Experimental Station, Summerland, B.C. by R. C. Palmer. The original tree was planted in November 1928, and produced the first fruit in 1932. The variety was selected by A. J. Mann in 1934, and named in 1936. Spartan was chosen because of the robust nature of the tree and good characteristics of the fruit.

Spartan's intense color stands out in the fruit market

FRUIT CHARACTERISTICS OF COMMERCIAL APPLE VARIETIES GROWN IN B.C.

Cultivar	Size	Shape	% red	Attractiveness	Firmness	Eating quality	Storage life at 31° F	Market
Delicious	Medium/large	Oblong-conic	100	Attractive	Firm	Good	Feb.*	Fresh
Golden Delicious	Medium	Oblong	None	Attractive	Tender	Good	Feb.*	Fresh
McIntosh	Large	Sl. oblate	40-100	Attractive	Tender	Good	Jan.*	Fresh
Newtown	Medium	Round	None	Moderate	Firm	Good	April	Processing
Rome Beauty	Large	Round	100	Attractive	Firm	Fair	March	Processing
Spartan	Medium	Round	100	Attractive	Moderate	Good	Feb.*	Fresh
Tydeman's Early	Large	Round	50-100	Moderate	Moderate	Fair	Oct.	Fresh, cooking
Winesap	Medium	Round	60-100	Moderate	Firm	Fair	May	Fresh

*May be extended by several months through Controlled Atmosphere (C.A.) storage.

Spartan bears heavily, and consistently at Summerland. The fruit requires moderate thinning, it picks easily, and is more resistant to preharvest drop than McIntosh. The skin is also thicker and tougher than McIntosh, giving it improved handling qualities, and more resistance to stem-puncturing.

Above all perhaps, it has that solid dark red blush that makes it stand out on the fruit market.

Spartan has stood the test for hardiness. The winter of 1949-50 was the most severe in the Okanagan region up to that time. Temperatures in some parts of the Valley dropped to —40°F. As a result of that exposure Spartan placed in the same category as McIntosh.

Early plantings of Spartan developed a type of breakdown in storage. It occurred in some years, particularly in fruit from orchards high in nitrogen and low in calcium. In 1969, half the fruit placed in storage was lost. This raised some doubts about Spartan, but the Summerland researchers worked for a solution. They recognized that, depending on the orchard site or season, the concentration of calcium occurring naturally in the fruit may not be adequate. This could be controlled by a summer-long spray program. However, such a program could be costly and time-consuming for the grower. A simpler method was needed. Post-harvest dip procedures were developed that were cheap and easy to use. Bins of Spartan going into storage were dipped in a solution of calcium chloride, and then placed in CA storage. The treated apples show no internal breakdown, and this is now standard practice in the industry.

Age, or Year Planted	Standard Trees	Dwarf Stock
Trees over 25 years	2,466	342
Trees #11 to 25 years	139,329	43,856
1966	12,652	10,072
1967	10,580	5,137
1968	14,389	12,676
1969	10,315	12,410
1970	8,672	11,667
1971	5,180	5,084
1972	3,305	1,985
1973	3,284	1,207
1974	566	1,224
1975	1,575	705
1976	1,024	1,850

Up to 1976, B.C. growers reported planting a total of 213,343 standard trees, and 108,215 dwarf trees of Spartan. The table at left shows the age, or number of Spartan trees planted in recent years.

Interest in planting Spartan in the Okanagan apparently peaked in the late sixties, however, there have been sufficient plantings in the seventies to ensure a continuing supply of fruit for years to come.

Certified propagating material in the form of bud sticks and scion sticks is made available to the nurseries through the B.C. Fruit Growers Associated Certified Budwood Scheme.

A lot of research and development went into the evolution of Spartan. But it is finally paying off for growers. Along with a better grade-out than McIntosh, Spartan is more economical to grow and sell. It is also opening the door to new markets for apples. That's what the research and development was all about. ■

COMPUTER-PREDICTED HARVEST DATES

R. TROTTIER

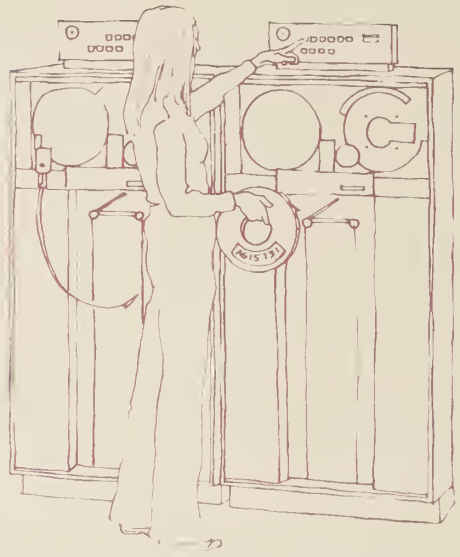
On a mis au point des ordinateurs qui, à l'aide de données météorologiques, prédisent la date de récolte des fraises et des pêches dans le sud de l'Ontario. La plupart des dates avancées en 1974, 1975 et 1976 pour les régions de Vineland, Simcoe et Harrow se sont révélées exactes à deux ou trois jours près.

Fruit growers and marketing boards need a reliable method of predicting harvest dates.

Picking dates vary from year to year, and from one fruit growing area to another because of seasonal and local weather conditions. Computer models using weather information to predict harvest dates would help growers, buyers and shippers to make plans before picking starts.

Ten years of phenological observations at Ontario's Horticultural Research Institute, Vineland Station, and the Horticultural Experiment Station, Simcoe, have been summarized and analyzed, using computer facilities at Agriculture Canada's Research Station at Vineland. Climatic models were developed to predict dates of the first commercial pick of three strawberry cultivars, Earlidawn, Veestar, and Redcoat and three peach cultivars, Earlired, Redhaven, and Veteran. Our goal was to make the predicted harvest dates accurate within 2 to 3 days, and to make this prediction 2 weeks in advance of the expected first commercial pick.

Developing the models Several workers have suggested that the interval between full bloom and fruit maturity is constant for a specific



cultivar and therefore can be used in determining harvest dates. At both the Vineland and Simcoe stations, however, this interval has been found to be too variable for use in estimating accurately the time of the first pick for the strawberry and peach cultivars mentioned above. One factor possibly contributing to the variability is the difficulty in establishing precisely the time of full bloom. From year to year, there may be deviations of several days in establishing when full bloom occurred.

Another method of determining harvest dates, which has been used extensively in relating crop maturity to climatic influence, involves the summation of degree-days. A degree-day (*dd*) is 1 degree above a threshold temperature for the duration of 1 day; *dd* = (maximum + minimum daily temperature) / 2- threshold temperature. To establish the proper threshold temperature for *dd* summations, six thresholds from 0°C to 5°C at 1° intervals were tested using a daily mean temperature from a Stevenson screen. Degree-days were calculated from March 1 and April 1 each year to the recorded dates of the first commercial pick for each cultivar from 1964 to 1973. Statistical analyses consisting of standard deviations, standard errors and coefficients of variation (%) were performed to determine which threshold and starting date gave the smallest statistical errors during the 10 years studied. Degree-day summations based on 0°C threshold from April 1 yielded the best relationship (model) for all strawberry and peach cultivars. The variance was still too large, however, to estimate within practical limits the dates of the first commercial pick.

It is well known that temperature measured in a Stevenson screen can differ significantly from the temperature at the crop level. To include in the model an estimate of the influence of radiant heat on fruit maturity, daily total bright sunshine hours (*sh*) were added to daily *dd* summations above 0°C; *ddsh* = daily degree-day + sunshine hours. Degree-day-sunshine-hour (*ddsh*) summations gave significantly better relationships with fruit maturity for all cultivars studied than did *dd* alone. With this model, variation was within 2 days for strawberries and 3 days for peaches.

Predicting first pick To be of value to the industry, predicted dates of the first commercial pick in southern Ontario must be available by approximately May 25 for strawberries and July 15 for peaches; these dates are at least 2 weeks before the earliest recorded dates of harvest for the years 1964-73. From April 1 each year, daily maximum and minimum temperatures, and sunshine hours, recorded in specific

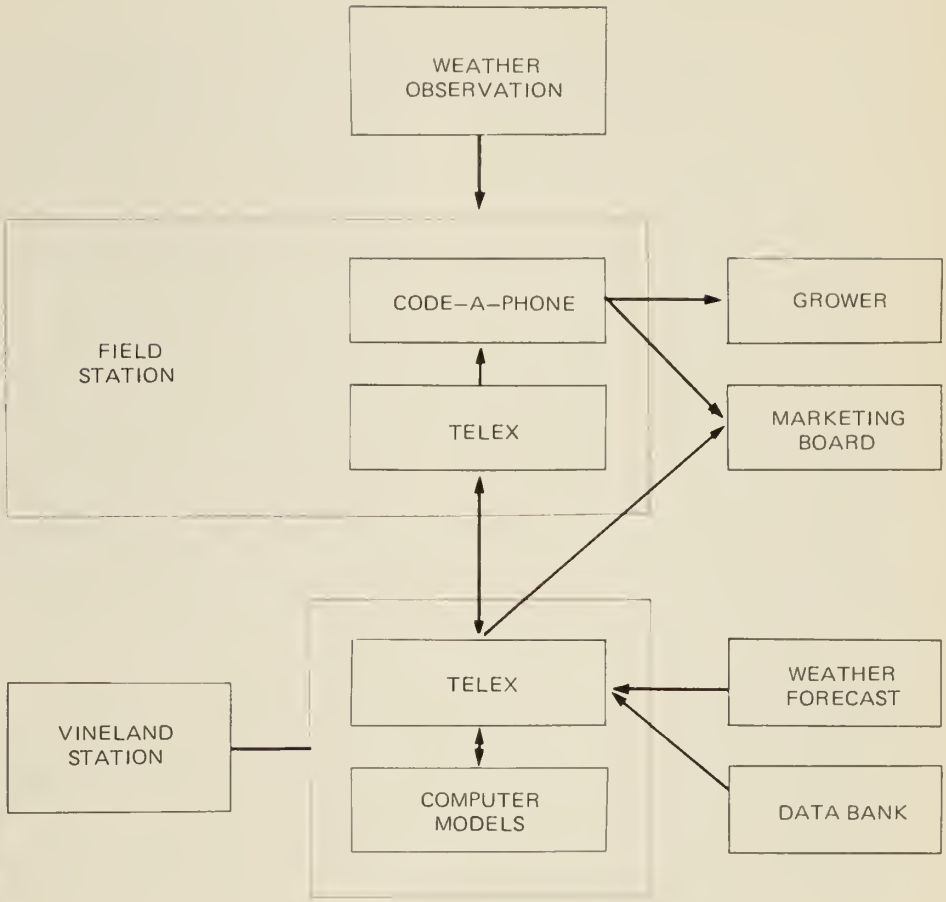
Dr. Trottier is an ecologist with the Agriculture Canada Research Station, Vineland, Ont.

fruit growing areas, are transmitted to the Vineland Station for computer processing (see diagram). When the data are transmitted via Data Telex, the weather data are fed directly into the computer. In this way *ddsh* summations are updated weekly in April and twice weekly thereafter, and checked against the computer models (*ddsh* normal curves). Normal curves are based on weather data files from the last 10-year period. Each year, normals are updated by 1 year. The computer output transmitted to each growing area is in terms of days ahead or behind normal. By knowing the normal *ddsh* for the first commercial pick for a given cultivar in a specific area, one can predict its occurrence. Two weeks before expected picking dates, 5-day weather forecasts are also used to optimize predictions.

First pick for all strawberry cultivars studied at Vineland and Simcoe is predictable within 2 days when based on 1365, 1380, and 1450 *ddsh* for Earlidawn, Veestar and Redcoat, respectively.

Computers provide a reliable means of predicting strawberry harvest dates

INFORMATION FLOW



First pick for all peach cultivars studied in relation with Vineland Rittenhouse (R) weather data is predictable within 3 days based on 2795, 3355, and 3795 *ddsh* for Earlired, Redhaven and Veteran, respectively.

From 1974-76, predicted dates were checked for the Vineland, Simcoe, and Harrow areas. Most predictions were within 2 to 3 days of the actual harvest dates. Although previous years' harvest dates were not used in developing the predictive model for Harrow, predicted dates of the first commercial pick were accurate for Redcoat strawberries and Redhaven peaches. Perhaps these computer models based on *ddsh* summations for predicting the first date of the commercial pick of strawberry and peach cultivars will be generally applicable in other fruit growing areas. Moreover, such computer models using real-time weather data should also be useful for predicting harvest dates of other heat-sensitive crops. ■

MORE PRODUCTIVE FARMING SYSTEMS WITH WHEAT

E. D. SPRATT and
A. P. PILOSKI

L'amélioration des productions végétales devrait se poursuivre grâce à la mise au commerce de nouvelles variétés et de nouveaux herbicides, à la mise au point de méthodes plus efficaces d'épandage des engrais, au perfectionnement du matériel de semis, à l'établissement d'un bon calendrier de travaux et à un assolement convenable.

Over the years, the Brandon Research Station has devised more productive farming systems with wheat, particularly in relation to moisture conservation, straw management, agrochemical inputs and cropping sequences. Here are some of the effects on farming practice resulting from research at the western Manitoba station; the area of applicability extends well into eastern Saskatchewan.

Moisture use Wheat-summerfallow cropping systems became common after the drought years. Farmers included fallow to conserve soil moisture, control weeds and reduce fertilizer requirements. However, research at Brandon showed that wheatfallow did not make efficient use of the available moisture. It used only 38.3% of the annual precipitation whereas continuous wheat used 78.5%, and continuous alfalfa used 90.8%.

Research also showed that fertilizers increased the efficiency of water usage. The addition of 41.5 kg N and 9.4 P/ha increased the amount of wheat grain product per unit of water used, from 76.7 kg/cm to 98.4 kg/cm (*2.5 bu/in. to 3.8 bu/in.*).

Summerfallow substitutes Summerfallow is not always necessary to conserve moisture for wheat production. There are alternatives. During the 1960's several crops such as sweet clover, flax, potatoes, sunflowers, corn, peas and beans were tried as alternatives to summerfallow. At Brandon, the best net returns were obtained when potatoes were used as a summerfallow substitute; wheat grown after sweet clover gave yields as high as wheat after summerfallow.

Summerfallow acreage has declined in the black soil zone. At present, about 16% of arable land in western Manitoba (1.5 million ac) is in summerfallow, compared to 25% in 1965. Coincident with this, potato and vegetable processing, corn distillation and oil extraction plants have been established, providing alternatives to cereals. The farmers of western Manitoba have now developed more productive cropping systems on less summerfallow, better chemical weed control, and more fertilizers.

Straw management and methods of seeding Straw management has become a problem with the decline in summerfallow acreage. Livestock cannot use the extra straw produced, and some farmers continually burn it off to ease cultivation and seeding.

There was a concern among farmers that extra nitrogen would be needed by soil microorganisms to decompose straw. Research at Brandon showed that a well fertilized crop is relatively unaffected by straw incorporation during early spring growth since the soil temperatures are low and straw decomposition does not start until soil temperatures have increased, by which

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time the crop is well established and can readily compete with the soil microorganisms that need nitrogen for straw decomposition. In fact, the addition of straw over the years increased the mineralizable nitrogen (nitrates) available for plant growth. Rates of nitrogen fertilizer recommended by the Manitoba Soil Testing Laboratory are therefore independent of the amount of straw on the field at sowing time.

In studies at Brandon and Melfort, annual burning of stubble did not increase yields; in fact, fall burning plus cultivation, a common malpractice, was one of the lowest yielding treatments. Discer seeding with packers gave the best results because of the economy of operations and better response to fertilizers.

Straw not only improves soil structure and moisture holding capacity but it helps to control wind and water erosion. Many studies including work at Melita, Manitoba have demonstrated that straw management (trash cover) is one of the most effective methods to control wind erosion.

Agrochemical inputs Studies at Brandon have shown that a larger application of phosphorus in 1 year benefits the crop over a number of years. In this 8-year study 100 kg/ha of phosphorus applied once was as good as a similar amount applied accumulatively with each crop in a wheat-flax rotation. At higher rates (200 and 400 kg/ha) phosphorus is expected to remain available to crops for periods up to 15 years. Farmers now know they can store phosphorus in the soil if there is an opportunity to invest. It has also been found that no response to fertilizer phosphorus can be expected when soils contain more than 15 ppm of $NaHCO_3$ extractable phosphorus.

Research and testing continues to develop systems for using new forms of fertilizer coming onto the market. Studies have shown that polyphosphates, a constituent of the new liquid fertilizers, are as efficient as the standard orthophosphates, hence solution and granular phosphate fertilizers with the same analysis can be recommended interchangeably.

Since urea breaks down rapidly in the soil, fertilizers containing urea should be well incorporated to prevent loss of nitrogen as ammonia. Other studies have shown that postemergence applications of N are as effective as preemergence applications and that solution N was as effective as granular N for postemergence application.

Since soil incorporated herbicides like triallate (Avadex) and trifluralin (Treflan) are compatible with nitrogen, herbicides and fertilizers can be applied together. Triallate incorporated with solution nitrogen has been found to be as effective as traditional methods of application. Combinations of fertilizers and herbicides improve efficiency, and various mixes of herbicides and extending agents may increase the effectiveness of weed control. For example, when TCA was added to 2,4-D and/or MCPA it enhanced the effectiveness of 2,4-D and MCPA for the control of broadleaf weeds and enabled TCA to control green foxtail without injury to wheat.

Forage crops Two studies at Brandon have shown that seeddown of forage crops, particularly clover and alfalfa, improves the soil by adding organic matter. The organic matter generates more soil nitrate and produces a better, higher protein wheat crop. A study at The Pas on saline-prone soils proved that brome-alfalfa, in rotation with wheat, controlled salinity and enhanced general productivity. Forage systems in this area could develop in a dairy industry to supply milk to northern mining communities.

Winter wheat Winter wheat is not a reliable crop on the southeastern prairies because uncertain snow cover does not provide adequate protection from severe cold. Rust damage is also more prevalent in the southeast. It has been demonstrated that winter wheat can be grown successfully in the northern regions at The Pas and Swan River where snowfall is more reliable and rust is less prevalent. Winter wheat would increase production substantially in these short season regions because of earlier harvests, and use of spring moisture.

Summerfallow substitutes and use of more agrochemicals has probably had a greater impact on total production in western Manitoba than the introduction of improved crop varieties. Introducing new varieties generally results in a gain of 2 to 3% in yield. Research into agronomic systems should increase production by 3 to 4% per year. ■

YELLOW TRAPS KEY TO MAGGOT DETECTION

W. NEILSON

Les producteurs ont établi leur calendrier de pulvérisation contre la mouche de la pomme d'après la sortie des adultes à partir de cages installées dans le sol. On a constaté que des rectangles jaunes enduits d'une substance gluante et suspendus dans les arbres permettent aussi de déterminer le temps de la sortie des adultes et le moment d'appliquer les pulvérisations.

The apple maggot is a major pest in northeastern North American apple orchards. Control requirements are very rigid as the tolerance for maggot-injured apples is zero for export and less than 4% for domestic markets. Consequently, the apple maggot is the target for annual applications of insecticides, and although various chemicals are recommended for control, the organophosphates are used in most areas. They provide protection by killing the adults before they have had the opportunity to lay their eggs.

The adults are small flies with black wing markings and emerge during the summer from the ground beneath apple trees. When the females emerge their ovaries are undeveloped and it is a week or two before they begin to lay eggs. This provides an opportunity to prevent injury and insecticide sprays are timed to coincide with the appearance of the adults. The first spray is applied within 7 to 10 days of the first emergence and subsequent sprays at 10- to 14-day intervals throughout the emergence period. The period is about 2 months

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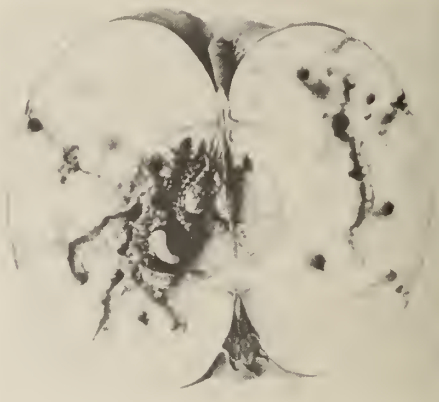


Top: Rectangular traps, placed in tree, are used to monitor fly emergence.
Left: Adult flies have distinctive wing markings.
Right: Channels made by maggots disfigure flesh of fruit.

long and usually three to five sprays are required for adequate protection.

Emergence periods are determined by using ground emergence cages which are prepared by placing maggot-infested apples on the ground in the year prior to emergence. These cages are maintained by federal, provincial, or state agricultural stations and growers are informed of the appropriate spray dates for their area by circular letters or radio bulletins.

Sprays based on emergence records have led to the use of a preventative (insurance) spray program, and although it has been satisfactory for growers with moderate or severe infestations, it has been most unsatisfactory for growers who do not have maggots or for those with light infestations. The latter have no way to determine their spray needs, and as a result have been applying the recommended number of sprays, whether needed or not, to ensure protection. This not only increases the cost of production, but also kills beneficial parasites and predators which prevent other orchard insects from obtaining pest status.

Fruit entomologists, aware of this problem for several years, have been seeking alternative methods for timing these sprays. Until recently, there were no simple methods for detecting the presence of adults in individual orchards and 'insurance' sprays were an accepted management practice. In the last decade, however, it has been discovered that the adults are strongly attracted to yellow rectangles which, when coated with Stickem or bird tanglefoot, make an excellent trap. These traps can capture the adults within a day of their emergence from the ground, and when properly deployed within individual orchards, will monitor adult activity and provide information on the need to spray and spray dates. Recent tests at the Kentville, St. Jean, and Vineland Research Stations have shown that sprays based on adult captures not only provided excellent control but also resulted in fewer applications. These traps can provide a 'spray-as-need' program for apple maggot and guidelines for their use are as follows:

- Place the traps in early and late maturing susceptible varieties bearing fruit, preferably in areas that were infested in previous years. One or two traps per ac should be sufficient.
- Hang one trap per tree at eye level on the south side, as near fruit as possible. All traps should be installed a few days before the adults emerge from the ground. Contact your extension entomologist for the emergence dates, as they vary appreciably depending on the area.
- Examine each trap at least twice a week for 6 weeks (or longer if captures are heavy) for the presence or absence of adult apple maggots. Identification sheets are available from extension entomologists or from federal and provincial agricultural stations.
- The first female capture will indicate the need for the first spray, which should be applied about 1 week after capture.
- The capture of females after the first spray will indicate the need for a second spray. Apply it 12 to 14 days after the first.
- A third or fourth spray will be necessary if female captures continue. Apply these at 12- to 14-day intervals.
- The removal of captured adults before spraying will make it easier to determine the need for subsequent sprays.
- Sprays are not necessary if females are not captured.
- If the trapping surface becomes cluttered with wind-blown debris and other insects, the trap should be replaced with a new one to provide efficient monitoring. ■

NEW ROSE SERIES MEETS DEMAND

H. H. MARSHALL

Une nouvelle variété de rose, Parkland, devrait répondre à une forte demande dans les Prairies. Créée aux stations de recherche fédérales de Brandon et Morden, elle possède des caractéristiques qui lui permettent de très bien s'adapter au climat des Prairies. Sa vogue pourrait aussi s'étendre dans les autres parties du pays.

Work continues in the attempt to provide better roses for the Prairie Provinces. It now seems that *Rosa arkansana* Porter hybrids will go far toward filling the large void in the gardens there. These hybrids, developed at the Agriculture Canada Research Stations at Brandon and Morden, are called the Parkland roses.

Potential advantages The Parkland roses have distinct advantages over existing types for ease of culture in the Prairie Provinces. In 1976, Morden received slightly less than half of its normal precipitation and yet a bed of Parkland roses bloomed very well. Bloom quality is similar to that of Floribunda roses in a range of colors from pink to many shades of red, white, and probably also yellow. Although most Parkland roses are not fully everblooming, they repeat more freely than shrub roses. They are winter hardy to a satisfactory degree. Some killing back is usual in both the Parkland roses and in their native parent, *R. arkansana*, but the roots remain healthy. Regrowth from the base is rapid and new stems produce flowers in July and September.

The Parkland roses root well from greenwood cuttings under mist. It is usual for 90% of the cuttings to root and be successfully transplanted. Selection for rooting ability has been an important part of the development of these roses because no existing rootstock is satisfactory on the Prairies. Winter-killing and profuse suckering because of injury are serious problems in all rootstocks. Because the Parkland roses can be propagated on their own roots, suckering is no longer a problem. Like their wild prairie ancestor, these roses usually have seven or more leaflets. This sometimes causes concern among growers because it is a characteristic of suckers from rootstocks used for propagating Hybrid Tea and other tender roses.

There is a subgroup of the Parkland series which is fully everblooming. It was discovered only 5 years ago and the results in this short period are exciting. The plants are basically vigorous, but they expend so much energy in bloom that they are usually less than 45 cm (*18 in.*) in height. They bloom on seedlings or cuttings 10-20 cm (*4-8 in.*) high. The flowers are up to 8 cm (*3 in.*) in diameter and have the same color range as the main group. They have performed well as pot plants and seem to have sufficient hardiness to survive in the Prairies with little or no special protection. They can be reproduced in quantity as cultivars from small greenwood cuttings or from seed for further selection. These large-flowered, everblooming miniature roses may be the most valuable result of this breeding program when they are fully evaluated.

Developmental Problems A number of difficulties were encountered in developing the Parkland roses. The wild parent is distantly related

Dr. Marshall is a rose breeder at the Agriculture Canada Research Station, Morden, Man.

to the cultivated roses. Crosses were successful in only a few combinations, but these were used in many further crosses. The numerous shades of color, produced by the interaction of 7-10 red, ivory and yellow pigments, was a further complication. Hardiness and disease resistance were required as well as plenty of attractive bloom. Therefore, large numbers of seedlings had to be grown for at least 3 years to find only a few with the combination of characters required in a garden rose.

Cultivar descriptions The first Parkland rose, Assiniboine, introduced in 1962, is a first generation Donald Prior x *R. arkansana*. It received an Award of Merit from the Western Canadian Society for Horticulture in 1965. It tip kills in most winters, but even when cut to the ground it produces purplish-red flowers freely in July and sparingly for the rest of the summer. It has not been widely accepted, possibly because the flowers have a conspicuous yellow open center and because it is susceptible to rust. It has been useful as a pollen parent in the breeding program and for bedding in sites where mechanical or winter injury is probable. The name comes from a Prairie Indian tribe.

The second Parkland rose, introduced in 1967, is Cuthbert Grant, [Crimson Glory x (Donald Prior x *R. arkansana*)] x Assiniboine. It also received an Award of Merit from the Western Canadian Society for Horticulture, in 1970, and was chosen as Manitoba's Centennial Rose the same year. The demand is strong. Small plants half the size of the usual commercial rose are selling at a premium. Besides being popular in the Prairie Provinces, it is gaining acceptance in other parts of Canada. While it is less hardy than Assiniboine, it survives well. Three specimens were planted in 1965 at Morden. They have never received special winter protection and in 1976 they were still in good health. Cuthbert Grant produces large, dark red, velvety semi-double blooms mainly in July and September. It is quite resistant to black spot and no other disease has been a problem. The name is that of a colorful fur trader who worked in that area which later became Manitoba.

The third Parkland rose, introduced in 1973, is Adelaide Hoodless, Fire King x (J. W. Fargo x Assiniboine). It seems to be just as popular as Cuthbert Grant. Like others of this series, it does kill back somewhat, but produces large clusters (up to 35 blooms) of 3-in., semi-double blooms in July and September. Peonin pigment in this rose contributes to a fluorescent cardinal red, not the usual purplish red as in Assiniboine and many Rugosa hybrids. It has been very effective in bedding, but at 1 metre (3 ft plus) in height, it is taller than desired for this purpose. It starts easily from greenwood cuttings and is fertile both as a seed and pollen parent. This rose was named after the founder of the Women's Institute on the 75th Anniversary of its founding.

Two new Parkland cultivars will be released through the Canadian Ornamental Plant Foundation in 1977. Morden Ruby is a sister of Adelaide Hoodless, with double ruby red, long-lasting flowers. Its growth habit is similar to the preceding cultivars. Morden Amorette is a large-flowered, everblooming miniature with semi-double carmine flowers. It performs well as a pot plant or low-growing garden rose.

Morden Amorette is a free flowering miniature rose.

Cuthbert Grant produces large semi-double blooms.

These two cultivars are expected to be on the market by 1979. In addition, there are many promising selections being evaluated in test plots.

We feel that Parkland roses are better roses for the Prairies. However, although they have been selected under Prairie conditions and have characters that are most desirable under these conditions, it is possible that some of these characters may be of value elsewhere. In northern and eastern areas there is increasing popularity of these roses. It is probable that they will be less attractive than the tender roses now being grown in favored localities, but under more severe conditions they are outstanding. ■

A DEVICE TO AGITATE CANS

P. PARCHOMCHUK

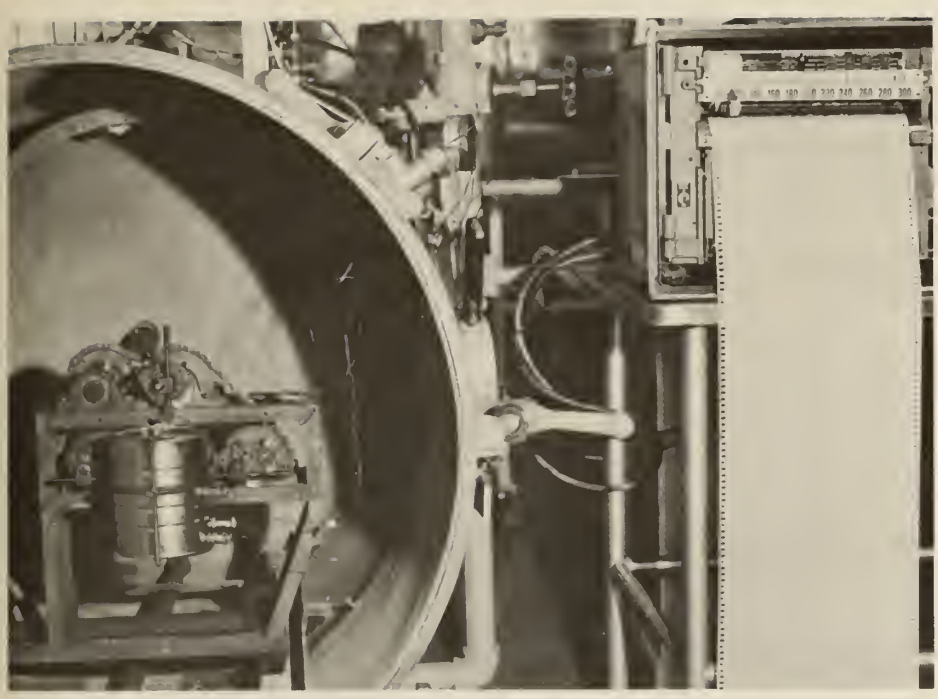
Les produits alimentaires visqueux, en particulier ceux mis en grosses boîtes de conserve, se réchauffent très lentement et il faut beaucoup de temps pour que le centre du produit atteigne la température voulue. Les chercheurs de la Station de recherche de Summerland ont mis au point une méthode d'agitation des conserves adaptée aux petits établissements de transformation.

Mr. Parchomchuk is an agricultural engineer at the Agriculture Canada Research Station, Summerland, B C.

A method of agitating cans suitable for small-scale processing plants has been developed at the Agriculture Canada Research Station, Summerland, B.C. Although several types of agitation processing retorts are commercially available, they are too expensive for small plants. Also, their installation usually requires extensive renovation of existing plant facilities. These retorts agitate cans by axial or orbital rotation as they are moved through the retort on reels or tracks.

Processing of certain foods requires agitation equipment. Small plants that don't have it must forgo processing certain foods or end up with an inferior product.

Most low-acid canned foods are processed commercially in large steam-filled pressure vessels called retorts. The food in all parts of the can must be heated to the process temperature and held there for a specified period of time to destroy harmful bacteria and spores. Viscous food products, particularly those processed in large cans, heat very slowly and require a long time for the center portion in the can to reach process temperature. The



Heat penetration tests were done using circular oscillation agitation.

A pilot plant model agitating apparatus was constructed.

food, then, near the walls of the can may become overcooked, losing much of its flavor and nutritive value. This problem can be prevented by agitating cans during processing. Agitation greatly reduces required heating and cooling time, thereby preventing loss of flavor, color and texture. The lower processing time also reduces energy consumption and increases output capacity per retort.

The method developed at Summerland of agitating cans oscillates those with a small-radius, 1.27-cm (*½-in.*) circular motion rather than with the large-radius, 76-cm (*30-in.*) rolling or rotating motion used by commercial equipment. The small radius motion requires less complex equipment and can be adapted to existing equipment without major modifications. In addition, since only a small space is used for can motion, more cans may be processed at one time.

Tests with this method showed a dramatic decrease in heating time. Bentonite clay mixtures were used for tests as this material has heating properties similar to many commonly processed food products. With no agitation, a 3.25% bentonite mixture has a "broken" heating curve typical of soups or tomato juice. A 5% mixture has a conduction heating curve similar to cream-style corn. Time for the slowest heating portion of a 100-oz can of 5% mixture to reach within 0.5°C of retort temperature (118°C) was reduced from over 360 min with no agitation to only 7.5 min when oscillated at 150 rpm with a 1.27-cm (½-in.) radius. However, at 125 rpm, heating time increased to 70 min. At oscillation speeds above 150 rpm heating time decreased, but not appreciably (Table 1). These

results indicate that a certain minimum oscillation speed is required for rapid heat penetration. If speed is lower than this value, heating rate decreases sharply. Little advantage is gained by oscillating at speeds faster than this value.

This optimum oscillation speed depends on certain factors, including oscillation radius, product viscosity, and can headspace. For a 5% bentonite mixture in a 100-oz can with 1.27-cm (*½-in.*) headspace, the optimum speed increased from 150 rpm to 325 rpm when the oscillation radius was decreased from 1.27 cm to 0.64 cm. With a less viscous 3.25% mixture, optimum speed was only 100 rpm with a 1.27-cm oscillation radius. A change in headspace volume from 1.27 cm to 0.68 cm caused optimum speed for a 5% bentonite mixture to increase from 150 to 300 rpm. Since a relatively small change in headspace volume causes a large change in optimum speed, headspace must be carefully controlled to ensure a uniform process for all cans. For practical application of this method, oscillation speed should be below 200 rpm; therefore, both headspace and radius should be at least 1.27 cm.

Orientation of the can during oscillation had no effect on heating characteristics. Regardless of whether the can was horizontal, vertical, or at an angle, optimum speeds and heating times were identical. This feature simplifies practical application of this method as no special can orienting or holding equipment would be required.

A pilot plant model was constructed to demonstrate how this method could be adapted to a conventional retort system. The apparatus consists of an oscillator, a hydraulic power unit and a retort cart.

TABLE 1 EFFECT OF 1 27-CM (½-IN) RADIUS OSCILLATION SPEED ON HEATING TIME OF 5% BENTONITE MIXTURE IN 100-OZ CANS WITH 1 27-CM (½-IN) HEADSPACE

Agitating speed (rpm)	Heating time (min)
0	360
125	70
150	7.5
200	6 2
400	5 0

The oscillator unit is mounted inside the retort and driven by a hydraulic motor. Power is supplied from an external hydraulic power unit with hoses extending through the retort wall. The cart full of cans is wheeled into the retort and positioned on rails attached to the oscillator unit. This procedure is identical to that used for a conventional retort system; thus, the only modification required is the addition of the oscillator and power units.

By incorporating a device of this type into a conventional retort system, it is possible to drastically reduce process time of viscous food products. In addition to improving product quality, the reduced process time increases plant output capacity and allows the small canner to process a wider variety of food products. Modifications and cost of equipment are minor when compared to the expense of installing present commercial agitation processing equipment. ■

APPLE PRODUCTION FOR JUICE

S. R. MILLER

Pour accroître la rentabilité de la production de pomme à jus, les chercheurs de Smithfield examinent les éléments qui ont permis d'accroître la production et de diminuer les coûts d'exploitation d'un verger de deux acres et quart.

The possibility of growing apples for juice has been studied at the Smithfield Experimental Farm for the past 3 years. A productive 0.91-ha (*2¼-ac*) block of McIntosh, Red Delicious and Red Spy apple trees planted in 1947 was used for the study. The trees, on *Malus robusta 5* rootstock, were spaced 10.5 m x 10.5 m (*35 ft x 35 ft*) apart, had a record of high yield over the past 10 years and had been pruned for fresh market production. For a juice block, fruit production had to be increased and the costs reduced.

Dr Miller is a plant physiologist at the Agriculture Canada Smithfield Experimental Farm, Trenton, Ont

Increased production Higher yields were obtained by applying 2.7 kg (*6 lb*) of NH_4NO_3 per tree on

A lab-size juice press at Smithfield gives workers a reading on the cider value of apple varieties.

an annual basis. Although a high rate of nitrogen increases fruiting, the quality is reduced for the fresh market. Winter hardiness may become an important factor but losses have not occurred at present. Once the conversion has been made to a juice operation it would be difficult to change back to a fresh fruit operation due to the effects of the added nitrogen.

Pollination is very important in a juice operation in order to obtain high yields. Extra beehives were placed in the block to assure production. Although the bees increase the costs, we have had more success in increasing yields by using bees than through any other management tool.

Delaying the harvest allows the fruit to increase to maximum size. With increased size and advanced maturity the fruit become easier to shake off the tree.

Reduced costs Costs that can be reduced are pruning, spraying and harvesting. Others such as tax, interest on money invested in property and capital costs are fixed, whether the orchard is operated for fresh fruit or as a processing block.

Pruning time was reduced from the normal 62-90 man hrs/ha (*25-40 man hrs/ac*) to 22 man hrs (*9 man hrs*) by making a few large cuts rather than a number of small ones. Only 15 minutes were allowed per tree, using 15-cm (*6-in.*) electric circular saws with 1.8-m (*6-ft*) handle extensions. How long production can be maintained with a minimal pruning program needs to be determined. Unless the shading reduces flower bud formation, limited pruning will be continued in order to develop a large fruiting area. A certain amount of pruning must be undertaken to promote and encourage the development of new fruiting wood.

In 1976, only two fungicide and three insecticide sprays were used, compared to 11 fungicide, five insecticide and one miticide applications to an adjacent block grown for the fresh market. All trees received a spray of Cyprex at the Silver Tip stage, followed by Difolitan at the 0.6-cm (*¼-in.*) Green Tip stage. The McIntosh trees received the full rate, whereas the Red Spy and Delicious trees had only half the recommended rate of Difolitan. Although some scab developed late in the season, the damage was not severe enough to be a detrimental

TABLE 1 COSTS ($/0.4 HA) INCURRED IN PRODUCING APPLES FOR THE FRESH MARKET AND JUICE.

	Fresh Market		Juice Block (Smithfield)			
	1973[1]	1975[2]	1974	1975	1976	
Orchard Overhead (Taxes, Interest)	133	149	133	133	165[3]	
Management (Salary)	30	58	30	30	60	
Labor (Pruning, Spraying, etc.)	52	132	50	66	55	
Equipment (Depreciation, Fuel, Repairs, Interest)	55	139	55	60	130	
					McIntosh	Del. & Spy
Materials (Sprays, Fertilizer, Mouse Bait)	60	134	100	140	90	64
Total Preharvest Costs	330	612	368	429	500	474
Harvest Costs (per tonne of fruit)	40	45			14[4]	12[4]

[1] Refer to E. D McKibbon, Apple Production in Ontario, 1973.

[2] Refer to Ralph Lawrence, A Survey of the Costs of Growing and Harvesting Apples in Eastern New York in 1975. Presented to 1976 Apple Conference by Darrel L Good

[3] Used land value of $3800/ha at 10% interest in 1976.

[4] Based on $3/hr labor rate

TABLE 2 SMITHFIELD HARVEST COSTS AND RETURNS FROM JUICE APPLES.

		Costs in $/0 4 ha			Returns per 0 4 ha		
	t/ha	Harvest	Preharvest	Total	Gross	Net	%
			1974				
McIntosh	25 86	150	368	518	635	117	22 6
Red Spy	29 40	140	368	508	721	213	41.9
Delicious	10 44	51	368	419	256	−163	loss
Av	21 90	114	368	482	537	167	11 4
			1975				
McIntosh	38 63	223	429	652	689	37	5.7
Red Spy	43 83	209	429	638	782	144	22 6
Delicious	39.04	190	429	619	696	77	12.4
Av	40 50	207	429	636	722	86	13.5
			1976				
McIntosh	38.88	225	500	725	1215	490	68
Red Spy	27 27	130	474	604	852	248	41
Delicious	37.51	183	474	657	1172	515	78
Av	34.55	179	482	662	1080	418	63.1
3-yr av	32.32	167	426	593	780	187	31.5

1 Juice price 1974 – $61.60/t
1975 – $44 80/t
1976 – $78 40/t

factor. Not only was the cost of spraying reduced, but also, there was less wear and tear on the equipment with only five applications instead of the usual 11.

Harvesting costs account for approximately one third of the total expenses incurred in producing apples. To reduce these costs, the fruit was shaken onto the ground, picked up and placed in bulk bins. Fruit was picked up from the ground at the rate of 4.59 hl/hr (*12¾ bu/hr*) compared to harvesting for the fresh market at about 1.80 hl/hr (*5 bu/hr*). Bulk bins saved considerable time in loading, filling and dumping the juice apples into the bulk carriers. The economics of some type of machine to pick fruit from the ground needs to be assessed as a further means of reducing costs.

Returns The costs incurred during the 3 years in growing apples for juice are summarized (Table 1) and compared to data obtained by other workers in 1973 and 1975. The returns, based on the experimental block, indicate that 1976 was the most profitable year due to high production and the price paid for juice apples (Table 2). It is apparent that with the fluctuating price paid for juice apples, annual yields of at least 22-33 t/ha (*10-15 tons/ac*) are required. This would be particularly true in areas where land prices are $7500-$9900/ha (*$3000-$4000/ac*), which adds substantial amounts to the orchard overhead. Only with the Delicious crop in 1974 were the calculated expenses in excess of the gross returns, which can be attributed to the low yields obtained that year.

Studies are being continued to determine if the yields can be maintained with the reduced pruning and spraying programs. ■

ECHOES
FROM THE FIELD AND LAB

ECHOS
DES LABOS ET D'AILLEURS

BEEF TEST FACILITY The Maritime Beef Testing Society has recently completed a new $40,000 beef bull test facility adjacent to the existing station, on property leased from the Experimental Farm, Nappan, N S.

The station has received good support from producers in the Maritimes. Over 700 bulls have been tested since the program began in 1966. In addition to testing, the station serves as a showplace for bulls which may be available for sale

The open-front, pole-type structure has a capacity for 50 bulls. It provides more space and was put into use in late January when a new group of bulls were put on test The building was financed by grants from the Nova Scotia, New Brunswick and Prince Edward Island Departments of Agriculture and the Canadian Hereford Breeders Association.

The open-front type structure, 110 ft long with a 78 by 110 ft outside yard area, has a capacity for 50 head.

SPECIAL UNIT FOR CO-OPERATIVES A publication released by the Information Division, Agriculture Canada, explains the objectives of a special unit created to serve the needs of the co-operative sector. The primary objectives are stated as being to provide technical information and advisory services to co-operatives and producer marketing boards, and to represent their interests in the formulation of government policy and legislation. It is mentioned that the Unit also serves as a source of information on producer marketing boards

The brochure, "The Co-operatives Unit, What It Is, What It Does", is available on request from the Information Division, Agriculture Canada, Ottawa, K1A 0C7.

EXPORT-MINDED FARMERS Agricultural and horticultural producers in Holland have associated themselves with the Nederlandse Export Combinatie (NEC), a foundation in SOEST which undertakes export-promoting activities. Sponsored by the NEC, producer companies exchange experiences and information and participate collectively in exhibitions abroad, to give an extra impetus to the export of their products. Through the organization, the foreign customer can be put into direct contact with the supplier who is specialized in the product desired.

NEC can arrange for the supply of any product required for the cultivation, protection, harvesting, storage, and processing of many types of agricultural and horticultural products.

COST OF WILD OATS The cost of wild oats to Saskatchewan last year was $311 million. Of this total, $237 million was lost in wheat and $74 million in other crops These figures were arrived at through the 1976 Saskatchewan Weed Survey, a joint project between Saskatchewan Agriculture's Extension Branch and the Regina Research Station.

Results of the survey were based on 20,440 weed samples from 1022 fields Almost 73% of the wheat fields surveyed contained wild oats, reducing the crop yield nearly 13%. Theoretically, 80% of this loss could be salvaged by wild oat control programs, less the cost of control. In 1976, about 19.5% of the wheat acreage received a wild oat herbicide costing about $20 million.

TEN MOST ABUNDANT WEEDS In the 1976 Saskatchewan Weed Survey, 118 different kinds of weeds were identified and the 10 found to be most abundant are listed in order of importance. They are green foxtail, wild oats, wild buckwheat, stinkweed, redroot pigweed, lamb's quarters, Russian thistle, cow cockle, perennial sow-thistle and wild mustard. Of the total number of weeds found, 50% were not controlled by 2,4-D and 27% were

CLEANER FEEDLOT CATTLE A special Committee for Cleaner Feedlot Cattle was named in 1972 to study the problem of dirty cattle received for slaughter at Canadian meat-packing plants The results of the study, and recommendations, are outlined in a publication released by the Information Division, Agriculture Canada. The author, J. E. Turnbull, Engineering Research Service, who was the Committee Chairman, states that the long-term answer to the problem is for producers to become aware of the improved gains and feed saved by keeping cattle dry and comfortable. Another essential step, he says, is to build in a more obvious and fair price differential for clean versus dirty cattle This price differential, Mr Turnbull states, must be more visible and applied more consistently than the present "tag docking" system used by cattle buyers.

The brochure is entitled "Cleaner Feedlot Cattle", Publication 1611. Copies can be obtained from the Information Division, Agriculture Canada, Ottawa, K1A 0C7.

RIDGED LAND BETTER FOR CORN Sweet corn grown on ridges establishes itself more rapidly than when grown on flat land, according to a report by A. R Maurer in the Agassiz Research Station Review Temperature readings showed that soil on the ridges was warmer than soil on the flat land. Soil moisture determination indicated that the moisture percentage decreased more rapidly in ridged land This combination of warmer and drier soil promotes better establishment of sweet corn plants. It was also found that ridges facing North-South give better results than those facing East-West Rapid development of the plant at an early stage could be of benefit at harvest. Floral initiation occurs before the plants reach 30 cm high and the potential number of ears per plant has been determined by this stage of development

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